REMARKS/ARGUMENTS

Prior to this Amendment, claims 18-37 and 50-65 were pending in the Application.

Claim 18 is amended to clarify the structure of a tab (e.g., a planar body attached at one end to the fin) and that the tabs are substantially all arranged to be less than about 20 degrees offset from the simple flow path across the fin. Claim 24, which depends from claim 18 is amended to correct a typographical error and to clarify that in each row of tabs that the tabs alternately extend from an upper or lower surface of the fin. Claims 30, 31, and 34, which also depend from claim 18, are cancelled.

Independent claim 50 is amended, with support found at least at paragraph [0051] and the figures, to call for a majority of the tabs to be aligned substantially parallel to local flow paths in the air flow passage or channel between fins of a heat exchanger.

Independent claim 57 is amended to clarify the formation of the tabs causes the fin body to have a particular porosity and the tab pattern provides higher porosity in areas of high cooling gas flow. Support for this amendment is found in Applicants' specification at least in paragraphs [0014] and [0048]. Dependent claim 62 is cancelled.

After entry of the Amendment, claims 18-29, 32, 33, 35-37, 50-61, and 63-65 remain for consideration.

Drawing and Specification Objections

The October 31, 2007 Office Action objected to the drawings for failing to show the features called for in dependent claims 30, 31, and 34 and also objected to the specification for failing to provide antecedent basis for claim 34. Instead of amending the drawings and specification at this time, claims 30, 31, and 34 are cancelled to address these objections and hasten allowance of the remaining claims.

Claim Rejections under 35 U.S.C. §102

The Office Action rejected claims 18-35 and 50-64 under 35 U.S.C. §102 as being anticipated by U.S. Pat. No. 5,697,432 ("Yun"). This rejection is respectfully traversed based on the following remarks.

As noted in paragraphs [0008] and [0009] of Applicants' specification, prior art finned-tube heat exchangers had attempted to enhance heat transfer by disrupting the boundary layers in the air flow as well as providing increased heat transfer area. This was done by "slitting the fin three or four times in the areas of the fin between the tubes" and by use of winglets and vortex generators. These devices typically created unacceptably large pressure drops as too much surface area faced into the flowing air (e.g., presented a large profile relative to the gas flow path within the fin channel) and/or were not adopted due to increased maintenance costs (e.g., the structures would snag or collect debris) or due to high manufacturing costs. The claimed fins address these issued by providing tabs that have configurations that lend themselves to easy manufacture, that limit maintenance issues, and that significantly increase heat transfer coefficients for fins without unacceptable pressure drops (e.g., paragraph [0069] discusses test results showing a 70 percent increase in heat transfer coefficient for a tabbed fin with a likely acceptable pressure drop increase of 50 percent).

To this end, claim 18 is directed toward a fin for use with tubes in a finned-tube, air-cooled heat exchanger. In addition to a fin body, a plurality of tabs are provided that extend at a bend angle from the two heat transfer surfaces of the fin body. Each of "the tabs comprises a substantially planar body with a first end attached to the fin body and a second end distal and unattached to the fin body." Such fins, that can readily be made by punching or other techniques, can be seen in Figures 6, 7, and 10, for example. The Office Action cites Yun in Figures 2 and 4-10 as showing tabs with its element 11. However, Yun fails to teach the tabs as called for in claim 18 because elements 11 are slits with a much different construction than required by Applicants' claim language.

More particularly, claim 18 requires that the tabs have "a substantially planar body." Yun teaches a fin 10 with a number of slits 11. The slits are shown in Figures 6 and 7 (and elsewhere) as being formed with two sidewalls 11a, 11b (with the "a" missing in Figure 6) extending from the surface of fin 10 to a slit body (called a "central portion of slits 11" at line 34 of col. 5) that extends parallel to the surface of fin 10 between the two sidewalls 11a, 11b. As will be appreciated, the slits 11 would produce different flow than the tabs of claim 18, and the fin 10 would have a different heat

transfer coefficient than the fin of claim 18 due to their differing porosity pattern (e.g., the slit body removes a significant amount of the fin 10 with heat transfer only through the sidewalls 11a, 11b to fin 10). Returning to the language of claim 18, the slits 11 are not planar. The slits 11 have three sides (e.g., two sidewalls and a slit body or central portion) and may be thought of as "U" or "C" shaped. Hence, the slits do not read on the substantially planar limitation of claim 18. Further, each of the tabs of claim 18 is attached at a first end to the fin body but includes a second end that is unattached to the body. In contrast, the slits 11 are attached via sidewalls 11a, 11b at both ends. For this additional reason, the tab limitations of claim 18 not anticipated by the slits 11 of Yun and fins including such tabs are believed allowable over this reference.

Claim 18 also calls for the tab bodies to be positioned at offset angles, and "substantially all of the tabs" have offset angles that are "less than about 20 degrees as measured from a simple flow path." Yun fails to teach that its slits 11 are so arranged, which would create a different flow over the fin 10. The Office Action cites Yun's teaching of "angles (theta 1)" as being less than 10 degrees as teaching this limitation. However, Yun teaches that a significant portion of the slit sidewalls are provided at an angle (theta 2) that is between 30 and 42 degrees. At the top of col. 3, the use of sidewalls at the theta 2 angle is provided to "increase the velocity of air flow passing near the periphery of heat transfer tube 20" to avoid stagnation. This would result in an increased pressure drop relative to a tab at an angle of less than about 20 degrees. Applicants' claimed fin, in contrast, provides tabs that are generally parallel to the simple flow path of air across the fin to provide an increase heat transfer area while providing a much lower pressure drop. The lower pressure drop is achieved in this case as a smaller profile is presented in the flow channel (also, see, claim 27 where the offset angles are less than about 10 degrees to assure an even smaller profile) and the profile is smaller since there is no slit body or central portion. It should also be noted that the slit bodies are not provided at an offset angle but are instead provided parallel to the fin body surface. For these additional reasons, the fin of claim 18 is not anticipated by Yun.

Claims 19-29, 32, 33, and 35 depend from claim 18 and are believed allowable over Yun at least for the reasons provided for allowing claim 18 over Yun. Further,

claim 22 calls for the tab bodies to be generally square or rectangular with "at least a partially curved shoulder at a leading edge." The Office Action fails to provide any reference to Yun for teaching this limitation and a review of the Yun figures provides no suggestion that the sidewalls of the slits 11 have curved shoulders. Claim 23 calls for the tabs to be less densely distributed "distal to the leading edge of the fin body", and, in contrast, Yun in Figure 6 shows more slits distal to the leading edge (or left side) of fin 10. For these additional reasons, claims 22 and 23 are not anticipated by Yun.

Claim 24 calls for adjacent ones of the tabs in each of the rows to extend from differing or opposite sides of the fin body. If Yun is said to teach the tabs of claim 18 with its slits, then Figure 6 shows that the slits in each row extend the same direction from the fin 10. However, if the sidewalls are said to teach the tabs of claim 18 (which Applicants do not accept), then the sidewalls of each slit extend in the same direction and do not show adjacent sidewalls in the same row each extending differing directions from the body of fin 10. Dependent claim 26 calls for the adjacent rows of tabs to be offset relative to each other such that the tabs are not coplanar. Yun fails to teach this limitation as it shows in Figure 8 that the inner sidewalls of slits 11 in sequential rows of slits 11 are coplanar. Claim 28 calls for the offset angles to differ for some of the tabs and to be selected such that the tab bodies are "substantially parallel with a plurality of predetermined local flow paths" across the fin or in the fin channel. The Office Action implies that angles theta 1 and 2 teach this limitation, but Applicants disagree as theta 2 is selected to be much greater than 20 degrees (as called for by Applicants) because it is intended that these sidewalls will change and disrupt flow (e.g., to direct flow at a faster rate to the wake region behind the tube) and not to minimize pressure drop by presenting less profile with each tab. For these additional reasons, claims 24, 26, and 28 are not shown or suggested by Yun, and Applicants request that these claims be found allowable over this reference.

Independent claim 50 is directed to a fin for use in a heat exchanger and the fin includes tabs extending outward from each side of the fin body. As with claim 18, the fins are attached to the fin body only at one end, and, hence, the reasons provided for allowing claim 18 relative to the slits 11 having a central portion and being attached at both ends via sidewalls 11a, 11b are equally applicable to claim 50. Further, claim 50

calls for "a majority of the tabs" to be arranged such that they are "substantially parallel to local flow paths." Yun fails to teach that a majority of its sidewalls 11a, 11b are substantially parallel to local flow paths. The Office Action towards the bottom of page 4 appears to indicate that the angles theta 1 and 2 were selected to match "a plurality of predetermined local flow paths for a fluid flowing." Applicants disagree. Sidewalls arranged at theta 2 are at a relatively large angle (30 to 42 degrees) with this angle selected to change the velocity of air and direct it toward wake areas behind tubes (see, for example, the top of col. 3). Further, the slits are selected to be relatively large in size (e.g., removed material from the fin body) and provided on opposite sides of the fin body "to maximize the turbulent current mixing effect." In contrast, the fin of claim 50 is arranged with a majority of the tabs provided substantially parallel to expected flow paths to minimize or limit disturbance and/or to avoid creating an undesirable pressure drop. Hence, Yun fails to show the tab structure called for in claim 50 and to show the positioning of such tab structure (e.g., parallel to local flow paths). Applicants request that the rejection of claim 50 be withdrawn as failing to teach or suggest the claimed fin.

Claims 51-56 depend from claim 50 and are believed allowable over Yun at least for the reasons provided for allowing claim 50 over this reference. Further, claim 52 specifies a number of possible shapes for the tabs, and the Office Action provides no citation to Yun for teaching this group of shapes for the Yun sidewalls 11a, 11b nor for the Yun central portions of slits 11. Claim 53 calls for "a larger percentage of the tab body surface area" to be located proximate to the fin body. The Office Action fails to provide a citation to Yun for this teaching. Based on a review of Yun, if the entire slit 11 is considered the tab of claim 50, Yun fails to suggest the limitation of claim 53 as the central portion is the majority of the surface area and it is distal to the fin body. If just the sidewalls 11a, 11b are considered the tabs, Yun still fails to suggest this limitation as the sidewalls are always shown to simply be rectangular (see Figure 7, for example). For these additional reasons, claims 52 and 53 are not anticipated by Yun.

Independent claim 57 is directed toward a fin with limitations similar to those found in claims 18 and 50, and the reasons for allowing those claims over Yun are applicable to claim 57. Further, claim 57 calls for the fin body to include openings adjacent the tabs such that the tab body "has a porosity of less than about 30 percent."

Dependent claim 62 originally called for a porosity of less than about 50 percent, but this claim was cancelled with the addition of the more limiting language to claim 57. The Office Action on page 4 fails to provide any citation to Yun for teaching or anticipating claim 62 let alone the lower porosity limit of claim 57. Yun appears to teach the use of large center portions for slits 11 which would likely result in a higher porosity than called for in claim 57. Further, claim 57 calls for areas of higher porosity to be provided in areas of high flow across the fin body. Yun fails to describe differing areas of porosity or that higher porosity is desirable in high flow areas. In contrast, Yun appears to provide the slits 11 to increase turbulent flow in low flow areas rather than providing additional slits in high flow areas such as upstream of tube collars 20. For these additional reasons, claim 57 is not anticipated by Yun, and Applicants request that the rejection be withdrawn.

Dependent claims 58-61 and 63-65 depend from claim 57 and are allowable over Yun at least for the reasons provided for allowing claim 57. Further, claim 61 calls for a majority of the tabs to be aligned substantially perpendicular to the leading edge of the fin body. Yun, as discussed above with reference to claim 18, fails to teach the tabs of the claims with its slits 11 having a large center portion extending between sidewalls. However, for the sake of argument but not as an admission, if the sidewalls 11a, 11b were considered the tabs of claim 61, Yun would teach away from the claimed fin as it shows in Figure 6 and elsewhere that a significant number of the sidewalls are at angles, theta 1 and theta 2, and are not perpendicular to the leading edge of fin 10. For this additional reason, claim 61 is believed allowable over this reference.

Claim Rejections under 35 U.S.C. §103

Also, the Office Action rejected claim 36 under 35 U.S.C. §103(a) as being unpatentable over Yun in view of U.S. Pat. No. 5,682,784 ("Stoynoff"). Claim 36 depends from claim 18 and is believed allowable over Yun at least for the reasons provided for allowing claim 18 over this reference. Further, Stoynoff is not cited for and fails to overcome the deficiencies of Yun discussed above in reference to claim 18.

Further, the Office Action rejected claim 37 under 35 U.S.C. §103(a) as being unpatentable over Yun in view of DE 3918610A ("Relfe"). Claim 37 depends from claim 18 and is believed allowable over Yun at least for the reasons provided for allowing

claim 18 over this reference. Further, Relfe is not cited for and fails to overcome the deficiencies of Yun discussed above in reference to claim 18.

Conclusions

In view of all of the above, it is requested that a timely Notice of Allowance be issued in this case.

No fee is believed due with this submittal. However, any fee deficiency associated with this submittal may be charged to Deposit Account No. 14-0460.

Respectfully submitted,

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